

IN THE CLAIMS

For the convenience of the Examiner, all pending claims of the Application are reproduced below regardless of whether amended or not.

1. (Currently Amended) An autoprotected optical communication system, comprising:

a first optical carrier configured to transport optical signals in a first direction;

a second optical carrier configured to transport optical signals in a second direction that is opposite to the first direction; and

a plurality of nodes connected along the first optical carrier and the second optical carrier to form bidirectional links, the plurality of nodes communicating in pairs, one of the pairs defining a working link associated with a portion of the first optical carrier and a portion of the second optical carrier and being configured to exchange optical signals using a first wavelength on the first optical carrier and a second wavelength that is different from the first wavelength on the second optical carrier during a normal condition, the one pair of nodes being configured to exchange optical signals using the first wavelength on the second optical carrier and the second wavelength on the first optical carrier during a failure condition, wherein a response to the failure condition is executed on a channel level, and wherein each of the communication system includes an optical switch unit that plurality of nodes includes a plurality of transmitting and receiving transponders, and wherein the plurality of transmitting transponders ~~include~~includes a first transmitting transponder optically coupled to the first optical carrier and configured to modulate a signal at the first wavelength, a second transmitting transponder optically coupled to the first optical carrier and configured to modulate a signal at a second wavelength, and a third transmitting transponder optically coupled to a second optical carrier and configured to modulate a signal at the first wavelength, the plurality of receiving transponders including a first receiving transponder optically coupled to the ~~first~~second optical carrier and configured to demodulate a signal having the first wavelength, a second receiving transponder optically coupled to the ~~first~~second optical carrier and configured to demodulate a signal having the second wavelength, a third receiving transponder optically coupled to the ~~second~~first optical carrier and configured to demodulate a signal having the second wavelength, and wherein, under the normal condition, optical switches in an optical switch unit are configured to connect an optical transmitter to the first transmitting transponder and to the third transmitting

~~transponder~~, to connect the first receiving transponder to the third transmitting transponder, to connect the second receiving transponder to an optical receiver, and to connect the third receiving transponder to the ~~optical receiver and to the second transmitting transponder~~.

2. (Original) The system of claim 1, wherein each of the plurality of nodes selectively uses a predetermined subset of wavelengths within a set of transmission wavelengths, each of the plurality of nodes comprising:

a plurality of optical add/drop multiplexers serially connected to the first optical carrier and the second optical carrier, respectively, each of the optical add/drop multiplexers configured to selectively perform at least one of adding the subset of wavelengths to the first optical carrier and to the second optical carrier, dropping the subset of wavelengths from the first optical carrier and the second optical carrier, and bypassing remaining wavelengths of the set of transmission wavelengths.

3. (Original) The system of claim 1, wherein each of the plurality of nodes comprises:

an optical transmitter;

an optical receiver; and

a reconfigurable optical switch unit selectively coupling the optical transmitter and the receiver to the first optical carrier and the second optical carrier.

4. (Canceled)

5. (Canceled)

6. (Currently Amended) A method of providing autoprotection in an optical ring network that includes a first optical carrier, and a second optical carrier, and a plurality of nodes connected along the first optical carrier and the second optical carrier and configured to communicate in pairs to define bidirectional links, the method comprising:

exchanging optical signals between one of the pairs of nodes over one of the bidirectional links by using a first wavelength on the first optical carrier and a second wavelength on the second optical carrier during normal operation;

detecting a failed link among the bidirectional links;

reconfiguring the nodes in the one pair to invoke a protection scheme that uses the first wavelength on the second optical carrier and the second wavelength on the first optical carrier to avoid the failed link, wherein the step of reconfiguring comprises switching optical connections which selectively couple an optical transmitter and an optical receiver to the first optical carrier and the second optical carrier; and

transmitting a failure message between the nodes in the one pair based upon at least one of non-receipt of the optical signals and receipt of the optical signals that are degraded, wherein a response to a failure condition is executed on a channel level, and wherein ~~the optical ring network includes an optical switch unit that~~ each of the nodes includes a plurality of transmitting and receiving transponders, and wherein the plurality of transmitting transponders ~~include~~ includes a first transmitting transponder optically coupled to the first optical carrier and configured to modulate a signal at the first wavelength, a second transmitting transponder optically coupled to the first optical carrier and configured to modulate a signal at a second wavelength, and a third transmitting transponder optically coupled to a second optical carrier and configured to modulate a signal at the first wavelength, the plurality of receiving transponders including a first receiving transponder optically coupled to the ~~first~~ second optical carrier and configured to demodulate a signal having the first wavelength, a second receiving transponder optically coupled to the ~~first~~ second optical carrier and configured to demodulate a signal having the second wavelength, a third receiving transponder optically coupled to the ~~second~~ first optical carrier and configured to demodulate a signal having the second wavelength, and wherein, under the normal condition, optical switches in an optical switch unit are configured to connect an optical transmitter to the first transmitting transponder ~~and to the third transmitting transponder~~, to connect the first receiving transponder to the third transmitting transponder, to connect the

second receiving transponder to an optical receiver, and to connect the third receiving transponder to the ~~optical receiver and to the second transmitting transponder~~.

7. (Original) The method of claim 6, further comprising:

using a predetermined subset of wavelengths within a set of transmission wavelengths carried by the first optical carrier and the second optical carrier, wherein the step of exchanging includes optically separating, at each node of the plurality of nodes, each wavelength of the subset of wavelengths from the set of transmission wavelengths.

8. (Original) The method according to claim 6, wherein the step of detecting comprises:

verifying, in each of the plurality of nodes and for each wavelength in the set of wavelengths, whether the optical signals are received.

9. (Original) The method according to claim 6, wherein the step of detecting comprises:

verifying, in each of the plurality of nodes and for each wavelength in the set of wavelengths, whether the optical signals are degraded.

10. (Original) The method according to claim 6, wherein the step of detecting comprises:

verifying, in each of the plurality of nodes and for each wavelength in the set of wavelengths, whether the optical signals include a failure message.

11. (Canceled)

12. (Canceled)

13. (Currently Amended) A reconfigurable node of an autoprotected optical communication ring network having a first optical carrier and a second optical carrier, comprising:

an optical transmitter configured to generate optical signals;

an optical receiver configured to receive optical signals; and

a plurality of transmitting transponders optically coupled to the first optical carrier and the second optical carrier;

a plurality of receiving transponders optically coupled to the first optical carrier and the second optical carrier; and

an optical switch unit that includes a plurality of optical switches coupled to the transmitting transponders and the receiving transponders, one of the optical switches being coupled to the optical transmitter, another one of the optical switches being coupled to the optical receiver, wherein the optical switches are configured to operate selectively under a normal operating condition and under a failure condition, the transponders using a first wavelength on the first optical carrier and a second wavelength that is different from the first wavelength on the second optical carrier during the normal condition, the transponders using the first wavelength on the second optical carrier and the second wavelength on the first optical carrier during the failure condition, a response to a failure condition being executed on a channel level, the optical switch unit including a number of switching blocks that is twice a number of protected channels, and wherein the plurality of transmitting transponders ~~include~~includes a first transmitting transponder optically coupled to the first optical carrier and configured to modulate a signal at the first wavelength, a second transmitting transponder optically coupled to the first optical carrier and configured to modulate a signal at a second wavelength, and a third transmitting transponder optically coupled to a second optical carrier and configured to modulate a signal at the first wavelength, the plurality of receiving transponders including a first receiving transponder optically coupled to the ~~first~~second optical carrier and configured to demodulate a signal having the first wavelength, a second receiving transponder optically coupled to the ~~first~~second optical carrier and configured to demodulate a signal having the second wavelength, a third receiving transponder optically coupled to the ~~second~~first optical carrier and configured to demodulate a signal having the second wavelength, and wherein, under the normal condition, the optical switches are configured to connect the optical transmitter to the first transmitting transponder ~~and to the third transmitting transponder~~, to connect the first receiving transponder

to the third transmitting transponder, to connect the second receiving transponder to the optical receiver, and to connect the third receiving transponder to the ~~optical receiver and to the second transmitting transponder~~.

14. (Canceled)

15. (Canceled)

16. (Previously Presented) The node according to claim 13, wherein the first wavelength and the second wavelength are selected from a set of transmission wavelengths, the node further comprising:

a plurality of optical add/drop multiplexers configured to optically couple the transmitting transponders and the receiving transponders to the first optical carrier and the second optical carrier to feed and extract a subset of wavelengths from the optical carriers, and to bypass remaining wavelengths of the set of transmission wavelengths.

17. (Previously Presented) The node according to claim 13, wherein the optical switches include 2x2 switches.

18. (Previously Presented) The node according to claim 13, wherein the optical switches include 1x2 and 2x1 switches.

19. (Original) The node according to claim 17, wherein the optical switches include discrete switching components.

20. (Original) The node according to claim 17, wherein the optical switches include an integrated switching matrix.

21. (Original) The node according to claim 19, wherein the optical switches include at least one of opto-mechanical switches, thermo-optical switches, magneto-optical switches, liquid crystal switches, semiconductor switches, electro-optical switches, micro-mechanical switches, and lithium niobate integrated circuit switches.

22. (Currently Amended) The system of claim 1, further comprising:
another optical transmitter configured to generate an optical signal that includes information to be transmitted in the network; and
another optical receiver configured to receive an optical signal that includes information that has been transmitted in the network, wherein the plurality of transmitting transponders includes a fourth transmitting transponder optically coupled to the second optical carrier and configured to modulate a signal at the second wavelength, the plurality of receiving transponders including a fourth receiving transponder optically coupled to the first optical carrier and configured to demodulate a signal having the first wavelength, during normal condition, the optical switches being configured to connect the first receiving transponder to the third transmitting transponder ~~and to the other receiver~~, to connect the fourth receiving transponder to the other receiver, and to connect the other optical transmitter to the second transmitting transponder ~~and to the fourth transmitting transponder~~.

23. (Currently Amended) The method of claim 6, further comprising:
providing another optical transmitter configured to generate an optical signal that includes information to be transmitted in the network; and
providing another optical receiver configured to receive an optical signal that includes information that has been transmitted in the network, wherein the plurality of transmitting transponders includes a fourth transmitting transponder optically coupled to the second optical carrier and configured to modulate a signal at the second wavelength, the plurality of receiving transponders including a fourth receiving transponder optically coupled to the first optical carrier and configured to demodulate a signal having the first wavelength, during normal condition, the optical switches being configured to connect the first receiving transponder to the third transmitting transponder ~~and to the other receiver~~, to connect the fourth receiving transponder to the other receiver, and to connect the other optical transmitter to the second transmitting transponder ~~and to the fourth transmitting transponder~~.

24. (Currently Amended) The method of ~~claim 14~~ claim 13, further comprising:
another optical transmitter configured to generate an optical signal that includes information to be transmitted in the network; and
another optical receiver configured to receive an optical signal that includes information that has been transmitted in the network, wherein the plurality of transmitting transponders includes a fourth transmitting transponder optically coupled to the second optical carrier and configured to modulate a signal at the second wavelength, the plurality of receiving transponders including a fourth receiving transponder optically coupled to the first optical carrier and configured to demodulate a signal having the first wavelength, during normal condition, the optical switches being configured to connect the first receiving transponder to the third transmitting transponder ~~and to the other receiver~~, to connect the fourth receiving transponder to the other receiver, and to connect the other optical transmitter to the second transmitting transponder ~~and to the fourth transmitting transponder~~.